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Abstract: This poster will discuss the use of PID controller tuning rules to assist in the implementation of network computer based control systems. Such systems typically have a variable time delay associated with the transfer of information. PID controller tuning rules can be directly implemented with minimal capital investment.

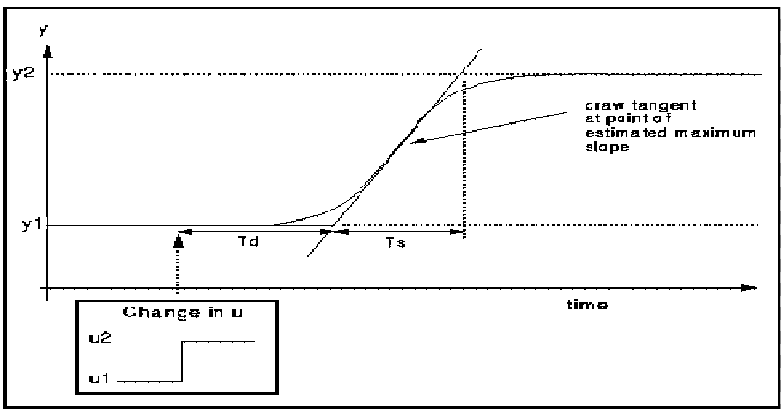
1. Introduction

In building industrial control systems, it is becoming increasingly common to use more sensors, actuators and microprocessor based controllers, to implement an intelligent digital system solution. As the number of devices grows, they need to exchange increasing amounts of data by means of various serial communications networks. Such networks (or fieldbuses) include Controller Area Networks (CAN), Profibus and Foundation Fieldbus. A practical problem with a networked control system is the time delay (or *latentcy*) associated with the transfer of information. This time delay may be deterministic, though it typically has a variable component (called *jitter*) [1], [2].

Networked control systems with such time delays may be compensated by using proportional integral derivative (PID) controllers; this controller is the most dominant form of automatic controller in industrial use today.

2. PID controller tuning

It is necessary to adjust the PID controller parameters according to the nature of the process; this tailoring of controller to process is known as *controller tuning*. The most convenient method of controller tuning is to use *tuning rules* (or formulae); one example of such a tuning rule is based on a measured step response, as indicated in the figure.



In the figure, K_m = model gain = ratio of the steady state change in process output to steady state change in process input = (y2-y1)/(u2-u1), Ts = model time constant and Td = model time delay. The PI controller settings are given by

$$K_c = \frac{0.9Ts}{K_m Td},\ T_i = 3.33Td.$$

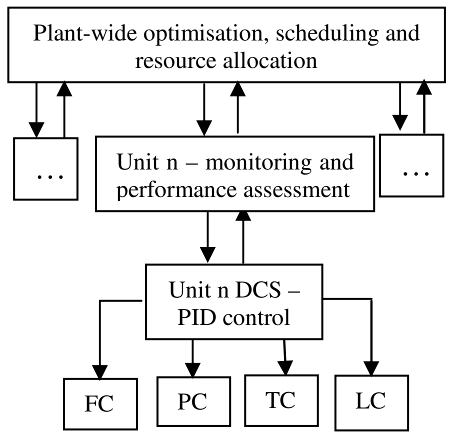
The (ideal) PID controller settings are given by

$$K_c \in \left[\frac{1.2Ts}{K_m Td}, \frac{2Ts}{K_m Td}\right],\ T_i = 2Td,\ T_d = 0.5Td.$$

The author has collated industry-relevant PID controller tuning rules in a recent book [3]. In the poster, the author will give a variety of examples and will detail some directly applicable controller tuning rules. Such tuning rules allow personnel to easily set up controllers to achieve optimum performance at commissioning. Importantly, they allow ease of re-commissioning if the characteristics of the process change (for example, due to wear on actuators).

3. Conclusions

PID controller tuning rules can be directly implemented in industry with minimal capital investment i.e. the hardware already exists, but it needs to be optimised. The outcome is directly measurable in, for example, reduced product variation, energy savings and reduction in waste. More fundamentally, since the PID controller forms the underlying layer in any enterprise-wide control system (as shown in the figure on the right), it is vital that the PID controller is optimised if the upper layers in the hierarchy are to perform.



DCS = distributed control system. FC = flow control, PC = pressure control, TC = temperature control, LC = level control

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